

Remarks

The Official Action is non-final and we concur that the claims in the case are Claims 1 – 3, 5 – 8 and 10. We appreciate the Examiner's courteous acknowledgment of receipt of all the necessary documents for the claims of foreign priority.

In regard to the Examiner's comments with relation to election, it will be appreciated from the remarks submitted in this response that the Applicants are not claiming specific features of the process as distinguished between dealkylation, transalkylation or disproportionation. The invention is directed to a preliminary process which greatly assists and enhances any processes of the mentioned groups. Accordingly, we appreciate and understand that the restriction requirement is designated "final," and that the claims as amended are all in proper condition for allowance wholly independently of any such requirement for election. Appearance of the expression "transalkylation" in Claim 3 is in accordance with the Applicant's election.

In regard to the comments under §112, the Applicants have cancelled Claims 2, 7 and 8. In answer to the Examiner's courteous query, the expression "Re" is used to designate rhenium and the quantities are expressed as parts by weight. This is supported at page 16, line 3 of the original specification, and elsewhere. Claim 1 has been amended accordingly.

Claim 1 has also been amended to recite that the aromatic hydrocarbons comprises 5 to 80% by weight benzene and that there is more than 10% by weight non-aromatic compound. Support may be found at page 11, last line and page 15, line 7, respectively.

Turning now to the prior art, we have carefully studied the patent to King et al., No. 5,952,535 (hereinafter "King '535" or simply "King"). In connection with the analysis of King, it is important to review the Applicants' specification and examples, and the language of the amended

claims, in order to emphasize the Applicants' claimed invention with further particularity.

The Applicants have made the remarkable discovery that, in attempting to obtain the indicated benefits when using crude petroleum or other crude material as a starting material, the Applicants make a determination of the amount of NON-aromatic materials present in the crude. The Applicants have discovered that significant quantities of non-aromatics have a serious negative influence on the beneficial properties intended to be enjoyed in the processing of the aromatics.

In their specification, the Applicants have pointed out that it is commercially important to separate benzene from gasoline to meet important environmental requirements. This requires a relatively large amount of benzene to be removed from the gasoline. It is known to utilize the benzene by mixing it with C9+ aromatic hydrocarbons to yield toluene and xylene through transalkylation. However, in practice, benzene is often extracted from gasoline by distillation and, therefore, contains a large amount of non-aromatic compounds having a boiling point range near that of benzene. This is especially true of non-aromatic hydrocarbons such as olefins and naphthenes. When such a benzene fraction is directly transalkylated with C9+ aromatic hydrocarbons in the presence of hydrogen, the process results in a side reaction of paraffin decomposition, which is troublesome because of large hydrogen consumption and large production of decomposition heat.

The Applicants have discovered a new way to convert a benzene-containing aromatic hydrocarbon material into C7, C8 and other useful aromatic hydrocarbons, with increased production of useful aromatic hydrocarbons. This can even be accomplished in a manner to reduce the benzene content of the product, by enjoying reduced catalyst deactivation, and reducing hydrogen consumption.

In Applicants' invention, the starting material or crude material should be preliminarily treated by removing non-aromatic compounds from the crude starting material, reducing the non-aromatic compound content of the starting material to 1% by weight or less, before it is allowed to contact the catalyst to commence the catalytic reaction. Only after having effected that reduction can the modified starting material be permitted to be introduced into the reaction device and to come in contact with the catalyst and with the hydrogen contained in the reactor. This is a novel feature not contemplated by any of the prior art and not even considered in the only remaining cited patent to King. It is important to observe that where the starting material is converted into a product containing toluene and/or xylene, the toluene and/or xylene content of the starting material shall be lower than the equilibrium composition of toluene and/or xylene in the starting material. (For these and other reasons, the Applicants have introduced a few additional claims, all of which are dependent and which claims are numbered 11 - 16.) Claim 11 is supported at page 9 of the specification, lines 2 - 5 above the bottom line; Claim 12 at page 9, lines 1 - 10; Claim 13 at page 9, lines 11 - 14; Claim 14 at page 11, line 11; Claim 15 at page 11, line 12; and Claim 16 at page 16, line 9.

Applicants' examples emphasize the importance of the invention. Example 1 is conducted in accordance with this invention, with the important preliminary step of removal of non-aromatics. Applicants' Comparative Example 1 used the same crude material, but performed direct contact with the catalyst under the same conditions as Example 1. We submit herewith a Table based upon the figures set forth in the Applicants' Examples, showing a reduction in the product of non-aromatics from 19.5 - 10.7%, but increases in the percentages of benzene, toluene, C8 aromatics, C9 aromatics and C10 aromatics. This is, we submit, highly surprising and a very advantageous

invention. These results were achieved by (a) reducing the non-aromatic hydrocarbon content of the hydrocarbon starting material to a value of 1% by weight or less, (b) contacting the reduced non-aromatic content starting hydrocarbon material with a catalyst that is effective to cause a hydrocarbon reaction selected from the group consisting of transalkylation, dealkylation and disproportionation, and (c) to produce a product having increased contents of benzene and toluene, as compared to the product obtained with the starting material was not preliminarily treated and which comprised more than 1% by weight of non-aromatic hydrocarbons.

TABLE

| Product Components | Comparative Example Product | Example 1 Product (Percent/Weight) | Beneficial Effects Of This Invention |
|--------------------|-----------------------------|------------------------------------|--------------------------------------|
| Non-aromatics | 19.5 | 10.7 | Decreased almost to $\frac{1}{2}$ |
| Benzene | 7.7 | 8.0 | Increased |
| Toluene | 25.8 | 27.7 | Increased |
| C8 aromatics | 29.7 | 33.5 | Increased |
| C9 aromatics | 15.1 | 17.6 | Increased |
| C10 aromatics | 2.2 | 2.5 | Increased |

This is a concept not considered by the King reference whether taken alone or in view of the admitted art in the specification.

Whatever the content of non-aromatics might be contemplated by King, the whole disclosure misses the point of the amended claims.

Applicants, to perform their invention, take a crude oil or the equivalent, that has a non-aromatic content that is above 1.0% by weight. Applicants affirmatively process the crude material by distillation or otherwise, and thereby reduce the non-aromatic content to 1.0% or less before the resulting starting hydrocarbon material is permitted to contact the catalyst and initiate the reaction.

King's focus is entirely different -- he uses a prepared C9 aromatic feedstock and reacts it with benzene to furnish substantial amounts of ring ethylene groups to convert at least some of the

benzene to toluene or xylene under transalkylation conditions.

Applicants do not claim to have invented transalkylation. Nor do Applicants claim to have invented mordenites or rare-metal catalysts.

Applicants have discovered that the presence of more than one percent by weight of non-aromatic materials at the start is harmful to the process, that any excess of 1% of non-aromatic materials should be removed, and that the starting hydrocarbon material should not be brought into contact with the catalyst until that is done.

Referring specifically to the King '535 patent, it is clear from column 3 that King discovered a special catalyst to perform the transalkylation and disproportionation procedures, but in all of the cases cited in his patent a relatively pure starting material was assumed, and nowhere was there any suggestion of a starting material containing non-aromatic hydrocarbons in an amount of greater than 1% by weight. Further, nowhere is there any disclosure or suggestion of the step of reducing the amount of such materials prior to allowing contact of a refined starting material with the catalyst. Reviewing King's Tables and Examples, these starting materials seem to be synthetic feedstocks prepared for experimental use and not crude feedstocks as encountered in the refinery and as the original starting materials in the Applicants' case.

At the top of page 8 there is no comment by King about any aliphatic components since the reference is made to benzene compounds such as diisopropyl benzene, tetramethyl benzene, etc. etc. Indeed, we have reviewed every word of every page of the King reference and find that there is no suggestion whatsoever of the Applicants' concept of refining the starting material by reducing the non-aromatic hydrocarbon content to a value of 1% by weight or less before allowing any content of the starting material with the catalyst to initiate the reaction.

For all the foregoing reasons, and particularly in view of the amendments here submitted, we earnestly submit that the claims as amended ought to be allowed, which action is respectfully requested.

Respectfully submitted,


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